Python Programming

Geovisualization

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Outlines

- Interactive Map
- Folium Fundamentals
- Folium Advance

Folium

- Unlike static map visualizations, **Folium** provides a powerful and flexible platform for creating **interactive web-based maps**. Built on top of the **Leaflet.js** library and seamlessly integrated with Python, Folium enables users to dynamically render geographic data with interactive features.
- Users can easily add various spatial elements, including points, polylines, and polygons, to the map, and customize elements such as basemap tiles, visual styles, zoom levels, and initial map extents.
- This makes Folium particularly suitable for visual analytics, geospatial storytelling, and web-based GIS applications, as it bridges the gap between Python's data processing capabilities and rich browser-based visual interactivity.

Import Packages

```
# import packages
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import geopandas as gpd
import folium
import json
import numpy as np
import vincent
```

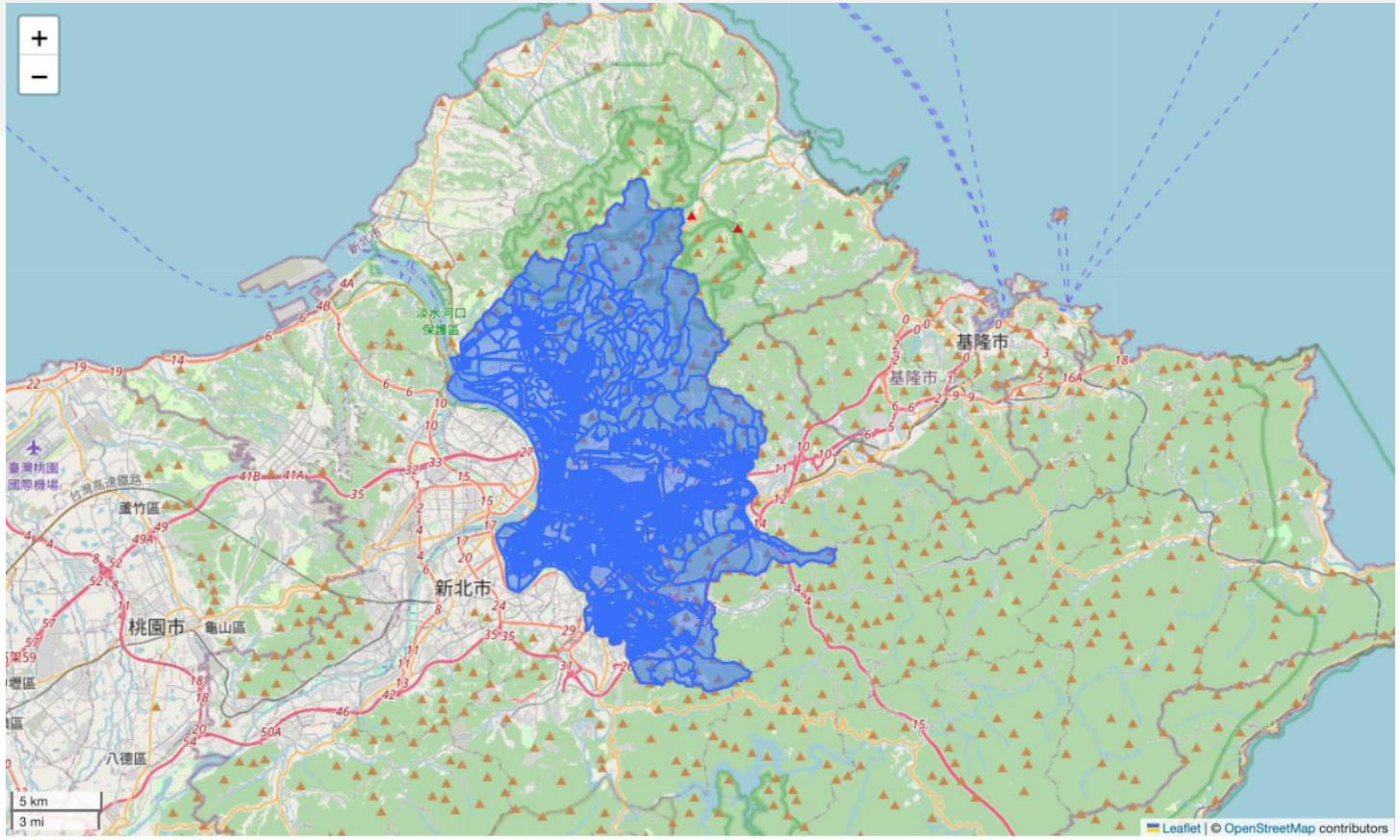
Read Files

```
# load data
os.chdir('GeoPandas')
daan = gpd.read_file('demo_DAAN.shp')
center = gpd.read_file('demo_center.shp')
tpe = gpd.read_file('demo_tpe.shp')
# preview dataset
tpe.head()
```

	Households	POP	X	Y	M_POP	F_POP	AREA	log_pop	dist	geometry
0	35	68	306723.98703	2.773600e+06	35	33	585896.25050	4.561483	1787.751626	POLYGON Z ((307356.325 2772974.783 0, 307357.8...
1	45	112	307070.50946	2.773329e+06	62	50	83428.10199	2.053078	2354.879192	POLYGON Z ((307247.391 2773495.672 0, 307283.9...
2	160	412	307176.11333	2.773214e+06	206	206	8678.32793	2.615950	2464.736182	POLYGON Z ((307289.353 2773209.31 0, 307057.11...
3	167	408	307174.35483	2.773178e+06	191	217	6648.78093	2.611723	2455.697901	POLYGON Z ((307292.525 2773182 0, 307061.46 27...
4	179	454	307178.78140	2.773148e+06	202	252	7393.97531	2.658011	2446.193344	POLYGON Z ((307296.152 2773150.768 0, 307169.2...

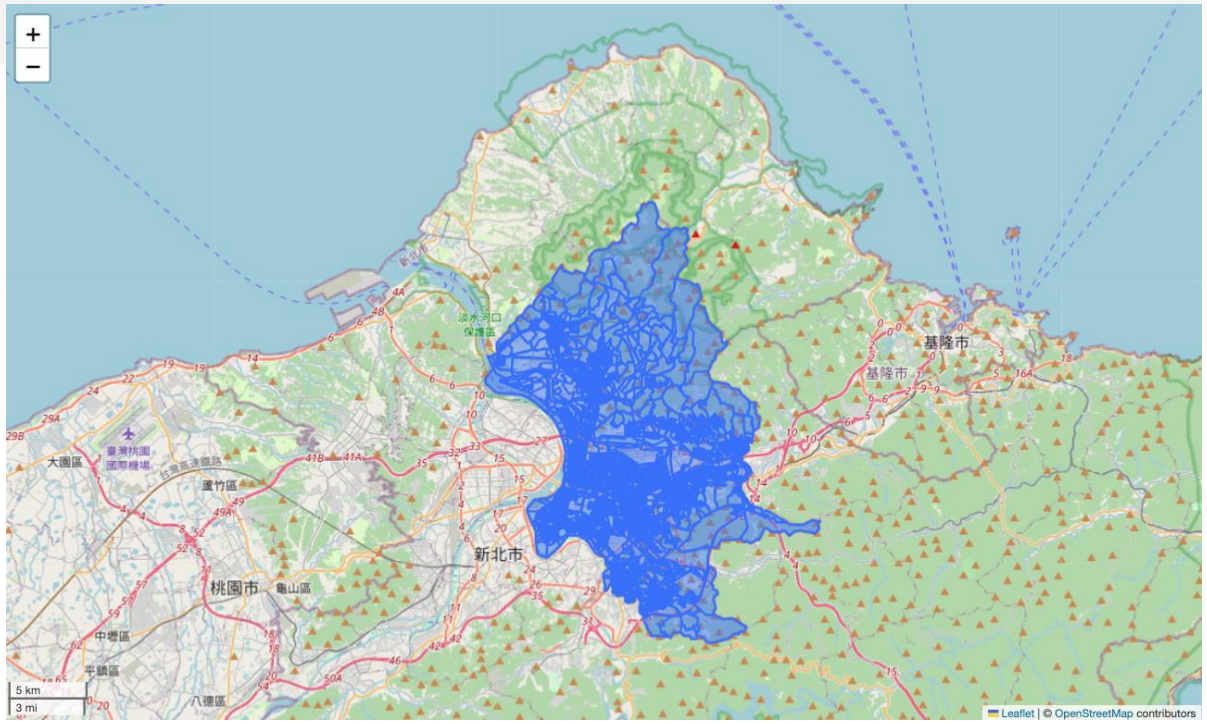
Simple Demo

```
# plot interactive map
tpe.explore()
```



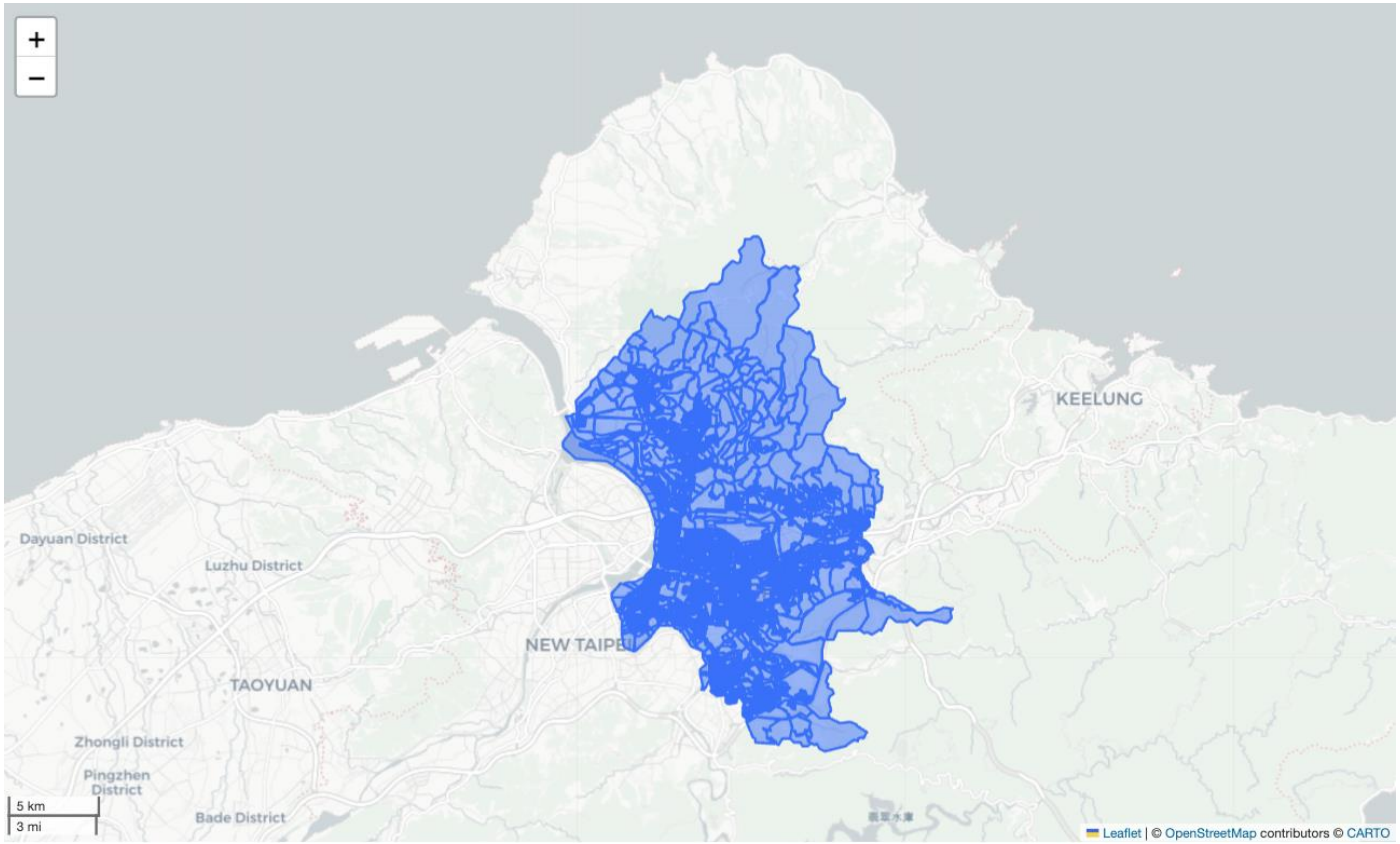
Anchor on Specific Location & Zoom

```
# adjust starting location & zoom scale
tpe.explore(location=[25.12, 121.53], tiles="OpenStreetMap",
            zoom_start=11)
```



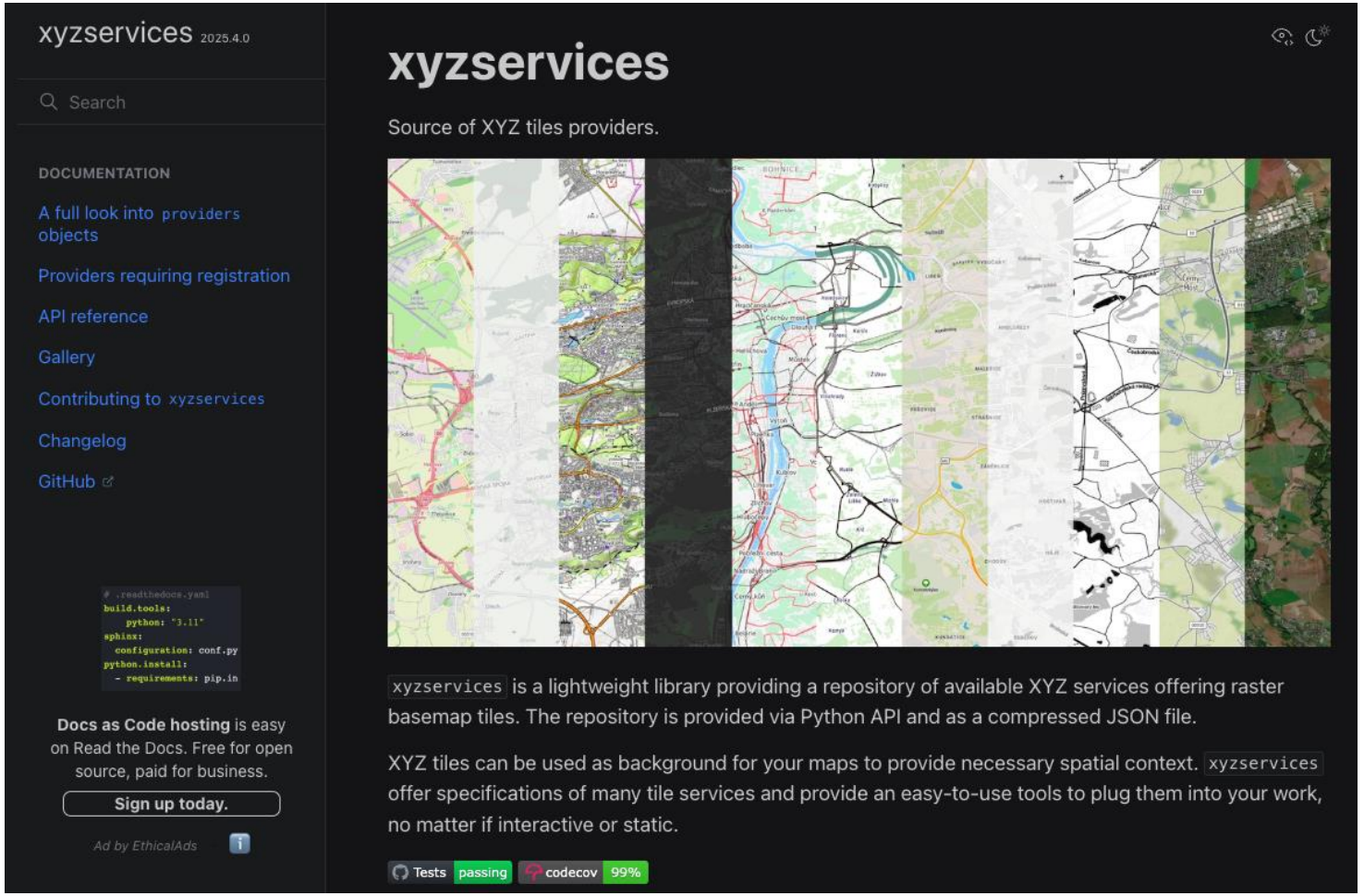
Change Tiles

```
# adjust tiles
tpe.explore(location=
        [25.12, 121.53],
        tiles="Cartodb
              Positron",
        zoom_start=11)
```



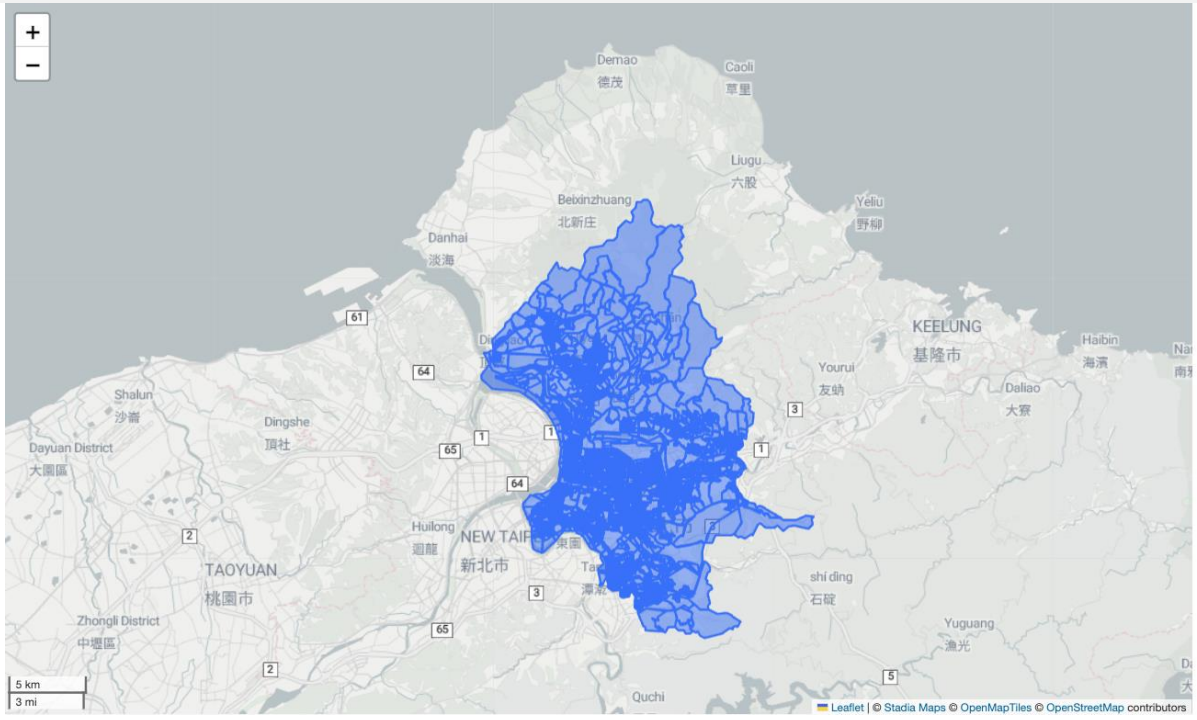
Tile Gallery

xyzservices
is a lightweight library providing a repository of available XYZ services offering raster basemap tiles. The repository is provided via Python API and as a compressed JSON file.



Tile Gallery

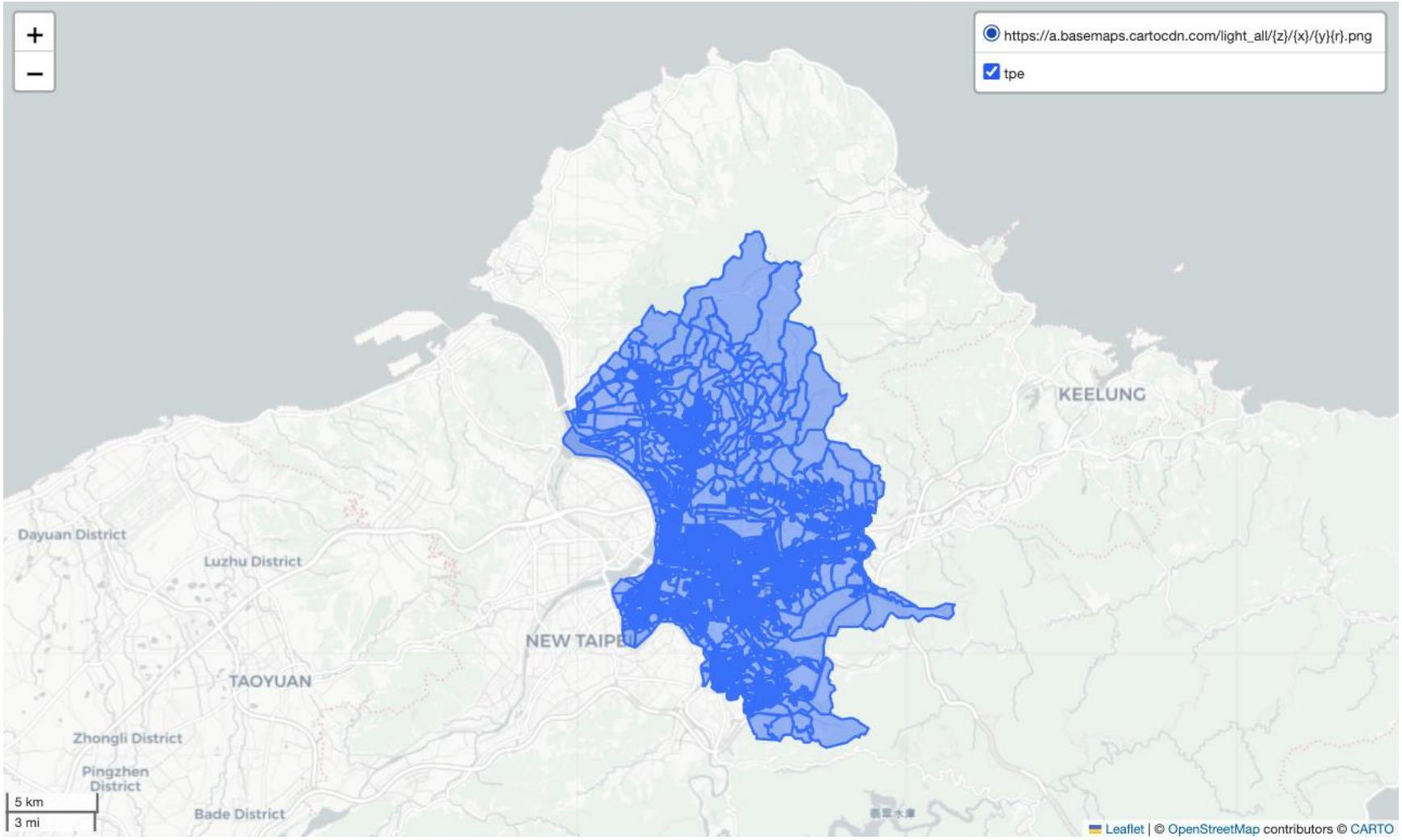
```
# adjust tiles
tpe.explore(location=[25.12, 121.53], tiles="Stadia.AlidadeSmooth",
zoom_start=11)
```



Add Layer Control

```
# add layer control
m = tpe.explore(location=[25.12, 121.53], tiles="Cartodb Positron", name='tpe', zoom_start=11)
folium.LayerControl().add_to(m)
m
```

Add Layer Control

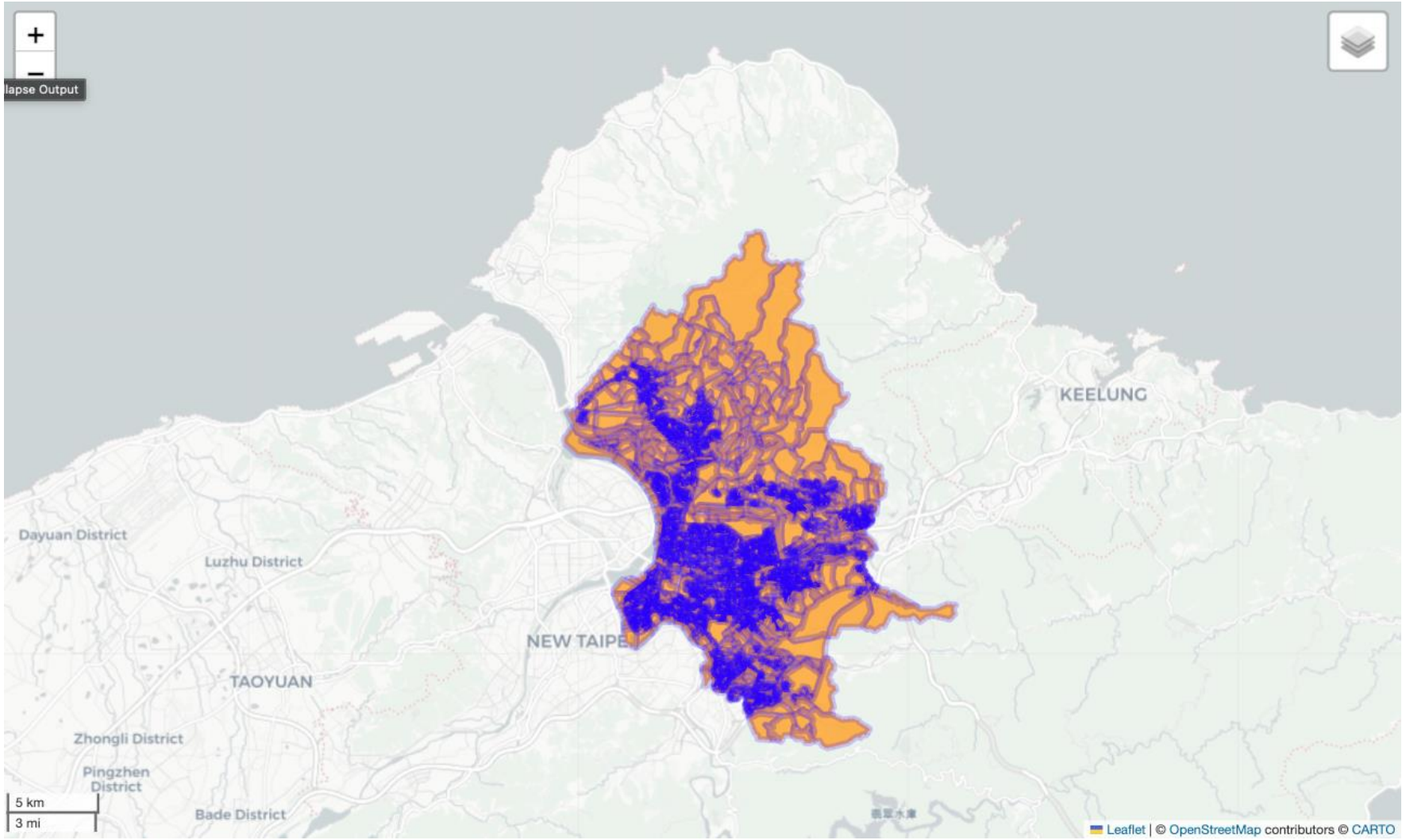


Change Facecolor and Edgecolor

```
# change facecolor and edgecolor
m = tpe.explore(
    location=[25.12, 121.53],
    tiles="Cartodb Positron",
    zoom_start=11,
    style_kwds={
        'fill':True,
        'fillOpacity':0.8,
        'fillColor':'orange',
        'stroke':True,
        'color':'blue',
        'weight':5,
        'opacity':0.2,

    })
folium.LayerControl().add_to(m)
m
```

Change Facecolor and Edgecolor

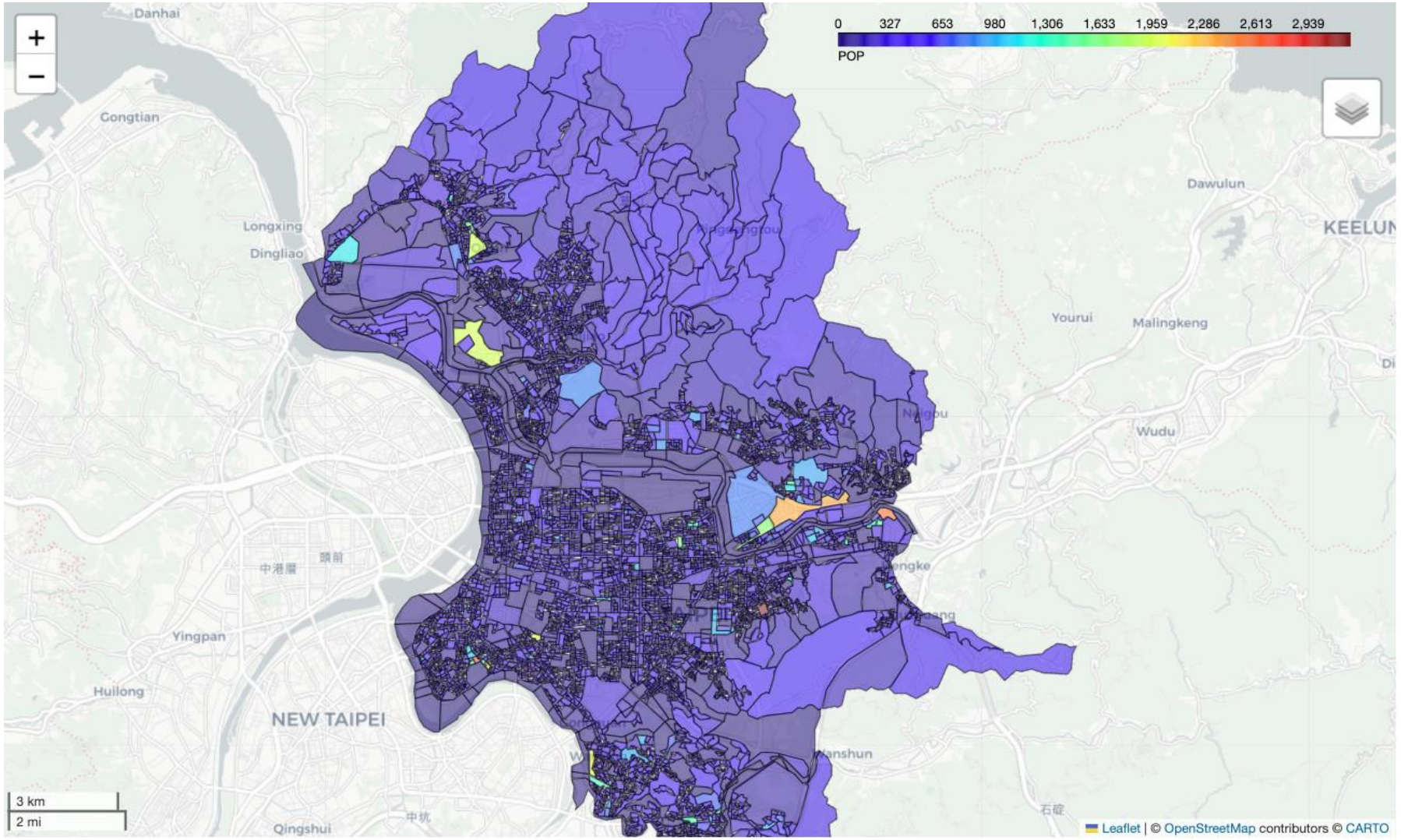


Graduate Colors

```
# colormap with column value
m = tpe.explore(
    'POP',
    cmap='jet',

    location=[25.12, 121.53],
    tiles="Cartodb Positron",
    zoom_start=11,
    style_kwds={
        'fill':True,
        'fillOpacity':0.5,
        'stroke':True,
        'color':'black',
        'weight':1,
        'opacity':0.5,
    })
folium.LayerControl().add_to(m)
m
```

Graduate Colors

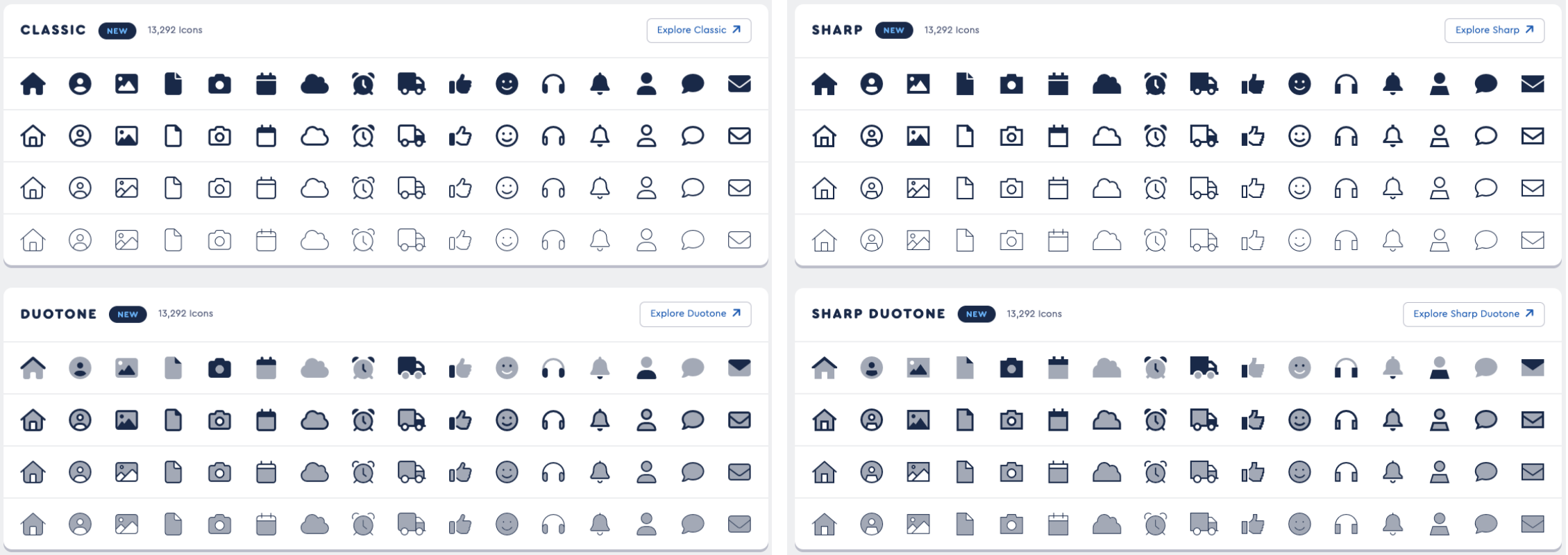


Add Marker (Point) & Change Icon

```
# icon changes
# x and y data
x_ = np.sort(np.random.uniform(size=(100,)))
multi_iter2 = {"x": x_, "y": x_**2}
# set scatter plot
scatter = vincent.Scatter(multi_iter2, iter_idx="x", height=200, width=300)
scatter.colors(brew='Set3')
# convert to json
data = json.loads(scatter.to_json())
```

Icon Styles

Icon style reference: https://fontawesome.com/icons?d=gallery

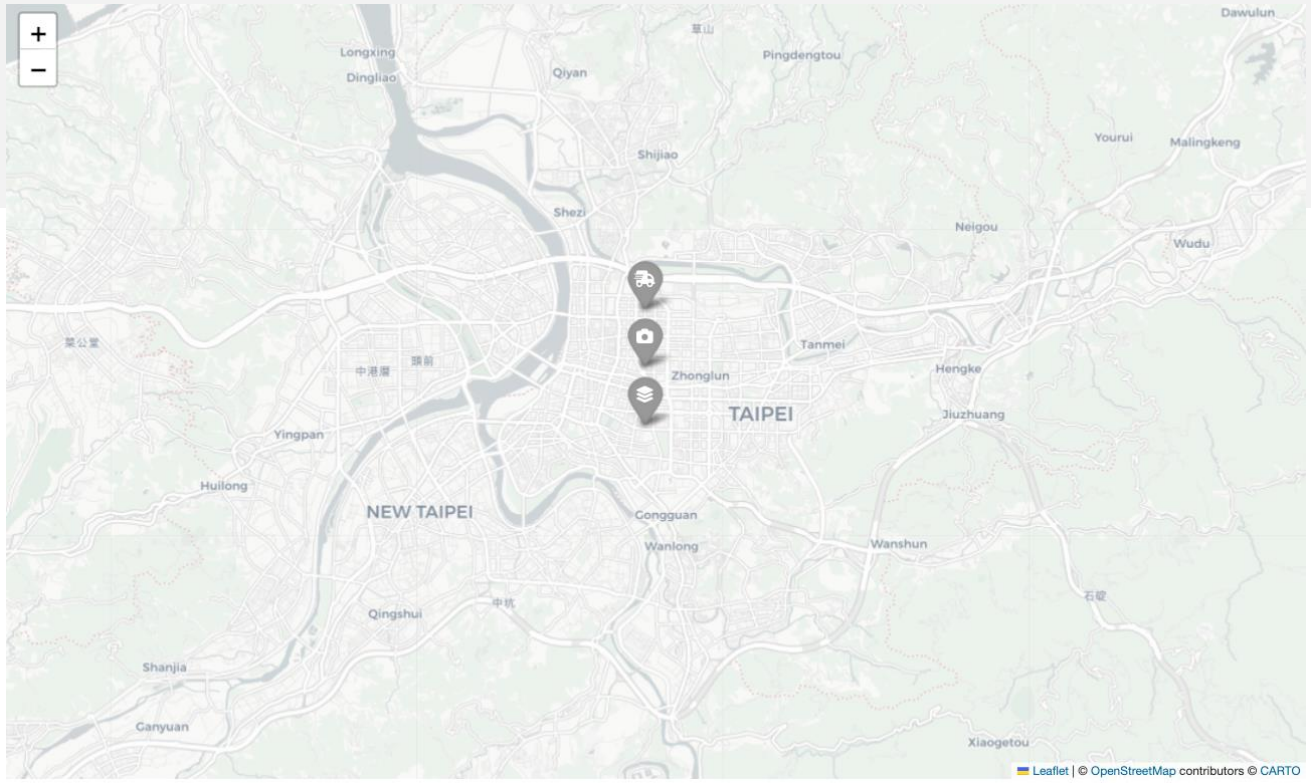


Add Marker (Point) & Change Icon

```
# plot map
m = folium.Map([25.05, 121.53], zoom_start=12, tiles="Cartodb Positron")
marker = folium.Marker([25.05, 121.53], icon=folium.Icon(color='lightgray',
                                icon='camera', prefix='fa')).add_to(m)
marker2 = folium.Marker([25.065, 121.53], icon=folium.Icon(color='lightgray',
                                 icon='truck-fast', prefix='fa')).add_to(m)
marker3 = folium.Marker([25.035, 121.53], icon=folium.Icon(color='lightgray',
                                 icon='layer-group', prefix='fa')).add_to(m)
popup = folium.Popup("Hello").add_to(marker)
```

Add Marker (Point) & Change Icon

```
# add popup map
folium.Vega(data, width="100%", height="100%").add_to(popup)
# map
m
```

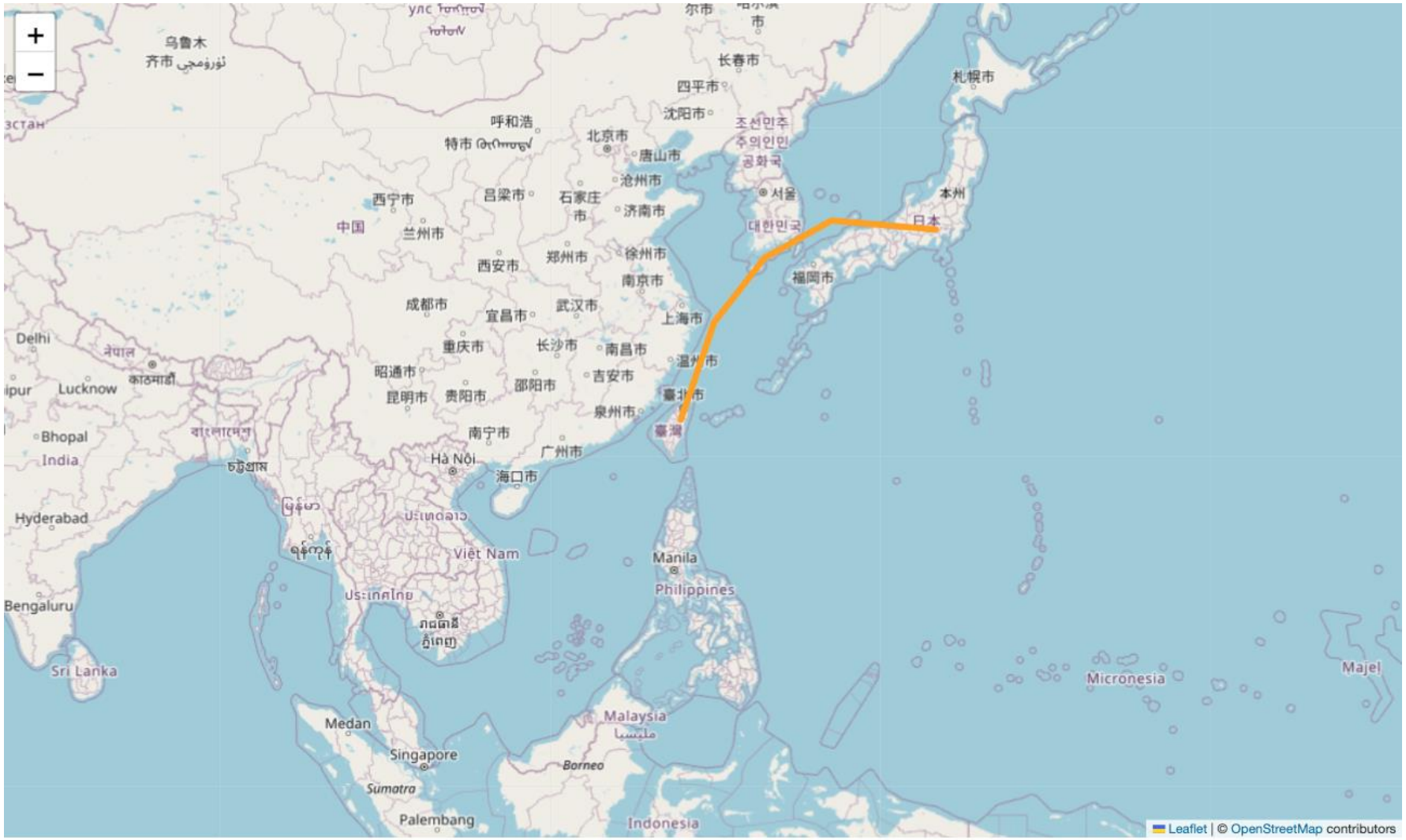


Add Polyline

```
# Coordinates are 15 points on
# the great circle from Boston to
# San Francisco.
coordinates = [
    [35.545617, 138.750054],
    [36.026943, 131.634392],
    [33.976440, 127.074539],
    [30.195193, 123.663155],
    [26.444179, 121.531269],
    [24.267498, 121.384035],
]
```

```
# Create the map and add the line
m =
folium.Map(location=[24.429633,
122.775422], zoom_start=4)
folium.PolyLine(
    smooth_factor=10,
    locations=coordinates,
    color="orange",
    weight=5,
    tooltip="from Japan to Taiwan",
).add_to(m)
m
```

Add Polyline

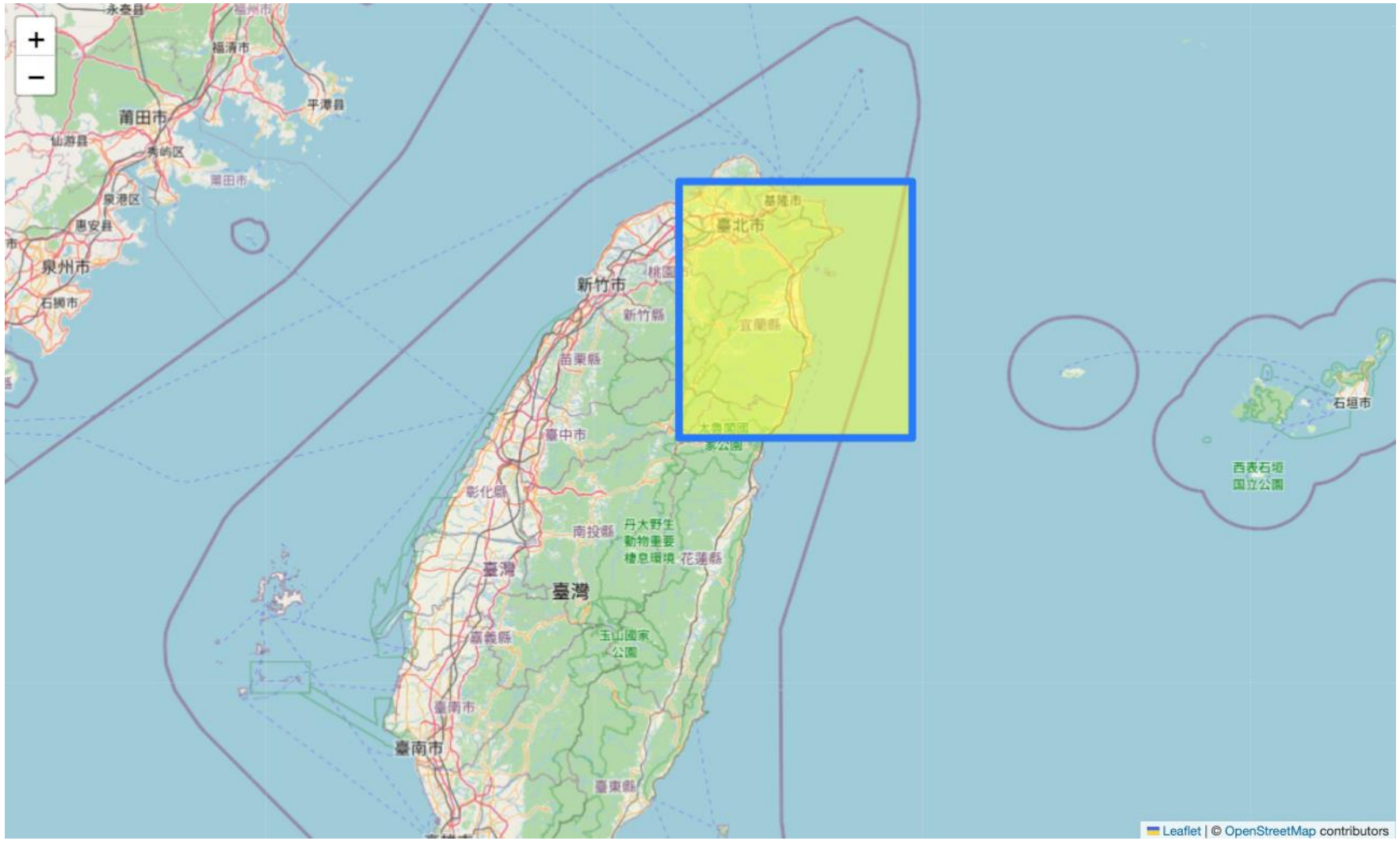


Add Polygon

```
#  add polygon
m = folium.Map(
        location=[24.267498, 121.384035],
        zoom_start=8)
        locations = [
            [24.2, 121.3], [25.2, 121.3],
            [25.2, 122.3], [24.2, 122.3]]
```

```
folium.Polygon(
    locations=locations,
    color="dodgerblue",
    weight=6,
    fill_color="yellow",
    fill_opacity=0.5,
    fill=True,
    popup="Tokyo, Japan",
    tooltip="Hello world!",
).add_to(m)
m
```

Add Polygon


臺北市
新竹市
臺中市
臺南市
臺灣
臺灣
泉州市
莆田市
石垣市
Leaflet | © OpenStreetMap contributors

The End

Thank you for your attention!

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